WHAT'S YOUR CAPACITY?

Brief Overview:

Students will learn to estimate and determine the capacity of containers using ounces, pints, quarts and gallons. They will be able to explain how to determine capacity measurements.

NCTM Content Standard/National Science Education Standard:

- Understand the need for measuring with standard units and become familiar with standard units in the customary and metric systems.
- Carry out simple unit conversions, such as from centimeters to meters, within a system of measurement.
- Understand that measurements are approximations and how differences in units affect precision.

Grade/Level:

This unit is for grade levels 4-5.

Duration/Length:

3 days - 50 minutes. Day 4 - 20 minutes.

Student Outcomes:

Students will:

- Identify standard liquid capacity units of measurement.
- Apply their understanding of equivalencies of gallons, quarts, pints, cups and ounces to make conversions.
- Solve problems by estimating measurements of liquid capacity.

Materials and Resources:

Lesson 1

- K-W-L Chart
- Empty Containers (Gallon, cup, pint etc.)
- Large Construction Paper (5 Sheets per group)
- Scissors
- Crayons
- Teacher Resource 1
- Stapler

Lesson 2

- Student Resource 2 and 3
- Teacher Resource 2 and 3
- Containers (gallon and pints for each group)

Lesson 3

- Prize
- K-W-L Chart from Lesson 1
- Teacher Resource 4
- Student Resource 4 and 5

Development/Procedures:

Lesson 1

Pre-Assessment

Begin by using a K-W-L Chart to determine what students "Know" and "Want to Know" about capacity. Fill in both sections and inform students that they will complete the "What I Learned" section on Day 3.

Launch

- Place containers in front of the classroom to demonstrate gallon, quart, pint, cup and ounce. Label each container with a number or letter.
- Begin with a personal story: *"Raise your hand if you've ever been shopping at the grocery store."* Explain to students that you went to the grocery store and bought a large container of milk. Have students identify which container the milk might be stored in. Ask students if they know what that unit of capacity is called. Students should answer, "gallon" or "quart." Repeat with ice cream and another liquid.

Teacher Facilitation/Student Application

- Write gallon, quart, pint, cup and ounce on chart paper to serve as a Vocabulary Chart.
- Allow students to work in groups to create a list of items that can be measured using a gallon, quart, pint, cup and ounce.
- Record a few responses on the chart paper to serve as a guide to students.
- Introduce the terms,"units and capacity," to students by including them on the Vocabulary Chart.
- Tell students that a unit is a term used to describe types of fixed quantities used to measure. For example, an inch is a unit. Allow students to pose other units. (yard, foot, gallon etc.)

- To describe capacity, hold up the gallon container. Tell students that the amount of liquid that can fill the container (or any container) is called capacity.
- A. Capacity- The volume of a container given in units of liquid measure. B. Unit- A scale used to measure.
- Students will then apply what they have learned by responding to the following teacher demonstration.
- Take the empty 1-gallon container and use the pint container to pour water into the 1-gallon container. Have students count along.
- After pouring 3rd-8th pint into the gallon container, ask students: *Is the container less than half, half or more than half full? How many cups would that be? How many ounces would that be? Etc.*
- Spend time discussing how the units relate to one another. (2 quarts equal a gallon. etc.)
- Show and explain the Capacity Unit Organizer model to students and tell them that they will create their own organizer. (Teacher Resource 1).
- Group students in groups of 3-4 students.
- Model how to create organizer (See Teacher Resource 1).
- Distribute supplies.
- Assist students with cutting and labeling.
- Model and Practice using organizer with students. Students can work in groups to answer the following questions using their organizers: *Possible Questions- Shawn has two cups of apple juice. How many pints does he have? (1 pint) Tanya drank 2 quarts of juice in one day. How many cups did she drink that day? (8 cups) If Tina has 4 cups of lemonade, how many ounces does she have? (32 ounces)*

Embedded Assessment

- Tell each student to take out a sheet of paper. Allow students to use their organizers.
- Explain that students cannot talk, and will record their answers to oral questions on their sheets of paper.
- Ask: *What items would you measure in ounces? (small amounts of liquids) Quarts? (larger amounts of liquids) How many ounces equal a cup? (8 ounces) How many ounces equal 4 cups? (32 ounces) How many pints equal a quart? (2 pints)*

Reteaching/Extension

- Students can write or draw their answers to the assessment questions.
- Ask students to draw or write about what would happen if they doubled the information in their organizer. For example: 2 Gallon = 8 Quarts etc.
- Reteach students who still need help with the concept by providing Student Resource 1).

Lesson 2

Pre-Assessment

- *Sam wants to make a pint of chocolate milk. How many cups will he need? How many ounces will he need?*
- Use answer from preassessment to review capacity. *Possible questions: 2 pints equal how many ounces? (32) 1 cup equals how many ounces? (8). (Allow students to use their organizers from the previous day.)*

Launch

- Tell students that today they will play a game called "What's Your Capacity?"
- Explain the rules for the game. (Teacher Resource 2)
- Break students into groups of 3 or 4 and distribute materials. (Student Resource 2 a-b)
- Model game procedure using 2 students.
- Allow 15-20 minutes for game.

Teacher Facilitation/Student Application

- Students will work in groups to answer the following questions: (Grouping can be at teacher's discretion.)
- Group 1: Kassandra wants to make 3 quarts of apple juice. She has 2 containers. They are filled to capacity. What size are they? (1/2 gallon and 1 quart)
- Group 2: Justin is carrying 4 containers of liquid from the grocery store. They are filled to capacity and contain 2 pints. What size are the containers. (4 cups)
- Group 3: John has 2 quarts of juice. How many ounces does he have? (32 ounces)

Embedded Assessment

- Students will complete a Frayer Model using the vocabulary word "Capacity". (Student Resource 3; Answer key: Teacher Resource 3).
- Model for students by completing one category of the Frayer Model. Allow students to complete the other 3 categories independently.

Reteaching/Extension

- *Heather wants to make 2 quarts of Kool-Aid. How many possible combinations of ounces, cups, pints and quarts can she use?* Students may use pictures, words, or numbers to answer.
- Begin drawing or listing items that relate to capacity. (milk containers, cups etc.) Allow students to continue this activity as follow-up at home. They can bring in items or continue the list or drawing.
- Continue working in small groups with students that still need assistance. Continue using Teacher Resource 1 if necessary.

Lesson 3

Pre-Assessment

Place a list of units of capacity on the board. (Half-gallon, 3 cups, 24 ounces). Ask students to put it in order from least to greatest.

Launch

- Show class 2 one-gallon containers. Fill one a quarter full. Fill the other 2 cups full. Ask students to estimate the capacity in cups, ounces, and/or pints.
- Then add the word Estimate to Vocabulary Chart with definition. Estimate- An approximate number that is close to the desired number.

Teacher Facilitation/Student Application

- Tell students that today they will play a game called "Around the World".
- Explain directions to students (Teacher Resource 4 a-e).
- Model each station for students.
- Break students into groups of 4-5 students per station and distribute Student Resources 4 and 5).
- Allow approximately 30 minutes for students to complete the activity. Allow additional time for students to calculate their results if needed.
- Give small prize for student who estimates the closest or has the smallest number in the "Score Difference" column.
- Allow students to explain conversion by asking questions. *Possible questions: If there are 2 ounces of water in the sponge, what would that look like in a cup? If there are 4 cups of iced tea, how many pints would that equal?*

Embedded Assessment

- Tell students to take out their K-W-L Chart and complete the "What I Learned" section of the sheet.
- Review with students and record responses on board or overhead for all students to see and copy.

Reteaching/Extension

- Students can create a poem/song about units of capacity. Allow students to work in pairs if necessary.
- Students will demonstrate knowledge of capacity through a dance or movement.

Summative Assessment:

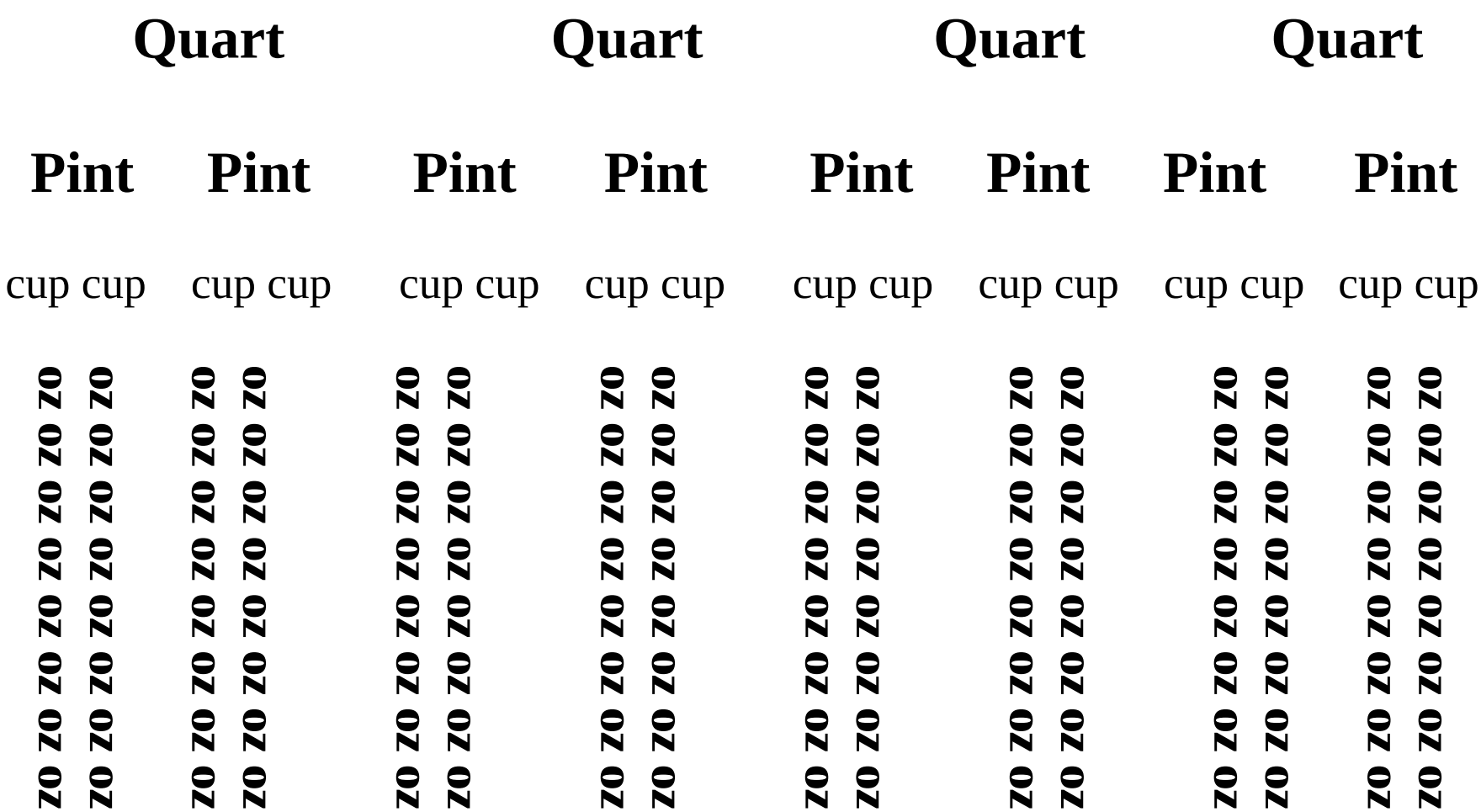
Students will complete a formal assessment to demonstrate their understanding of capacity. Students will complete a Selected Responses and a Brief Constructed Response. See Teacher Resource 5, Student Resource 6 and 7.

Authors:

Heidi Kunkle
Laurel Hall School
Washington County Schools

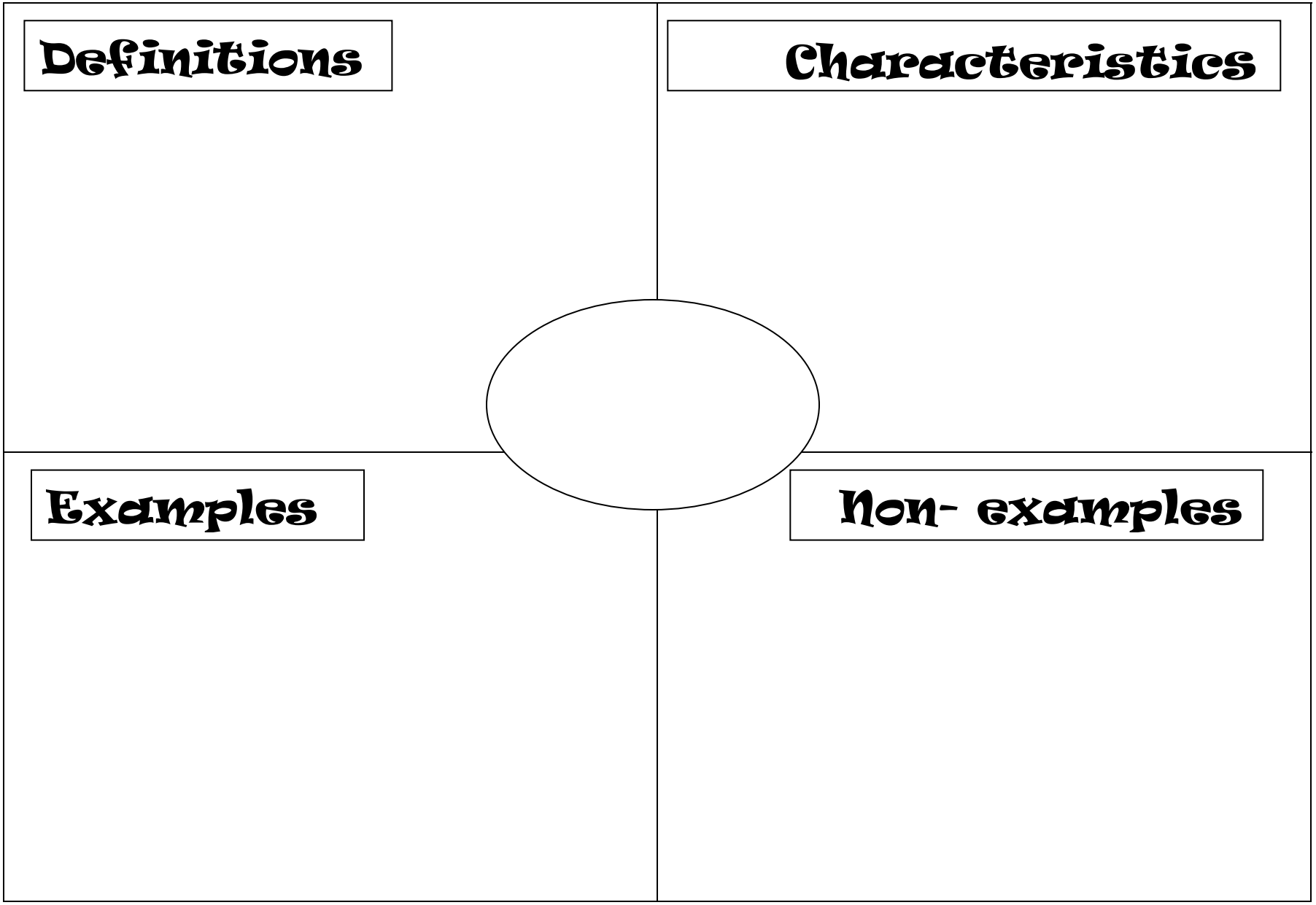
Adiaha Onyemaechi
Dr. Bernard Harris Sr. Elem. School
Baltimore City Public Schools

Gallon


Quart
Quart
Quart
Quart
Pint
Pint
Pint
Pint
Pint
Pint
Pint
Pint
cup cup
cup cup
cup cup
cup cup
cup cup
cup cup
cup cup
cup cup
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz

	cup	cup	cup	oz		oz	oz	
cup	cup	cup	cup	oz		oz	oz	oz
cup	cup	cup	cup	oz		oz	oz	oz
cup	cup	cup	cup	oz		oz	oz	oz
cup	cup	cup	cup	oz		oz	oz	oz
cup	cup	cup	cup	oz		oz	oz	oz
cup	cup	cup	cup	oz		oz	oz	oz
cup	cup	cup	oz	oz		oz	oz	oz
cup	cup	cup	oz	oz		oz	oz	oz
cup	cup	cup	oz	oz		oz	oz	oz
cup	cup	cup	oz	oz		oz	oz	oz
cup	cup	cup	oz	oz		oz	oz	oz
cup	cup	cup	oz	oz		oz	oz	oz
cup	cup	cup	oz	oz		oz	oz	oz
cup	cup	cup	oz	oz		oz	oz	oz
cup	cup	cup	oz	oz		oz	oz	oz
cup	cup	cup	oz	oz		oz	oz	oz
cup	Cup	cup	oz	oz		oz	oz	oz

Gallon	**Gallon**	**Gallon**	**Gallon**	**Gallon**
Gallon	**Gallon**	**Gallon**	**Gallon**	**Gallon**
Gallon	**Gallon**	**Gallon**	**Gallon**	**Gallon**
Gallon	**Gallon**	**Gallon**	**Gallon**	**Gallon**
Quart	**Quart**	**Quart**	**Quart**	**Quart**
Quart	**Quart**	**Quart**	**Quart**	**Quart**
Quart	**Quart**	**Quart**	**Quart**	**Quart**
Quart	**Quart**	**Quart**	**Quart**	**Quart**
Quart	**Quart**	**Quart**	**Quart**	**Quart**
Pint	**Pint**	**Pint**	**Pint**	**Pint**
Pint	**Pint**	**Pint**	**Pint**	**Pint**
Pint	**Pint**	**Pint**	**Pint**	**Pint**
Pint	**Pint**	**Pint**	**Pint**	**Pint**
Pint	**Pint**	**Pint**	**Pint**	**Pint**
Pint	**Pint**	**Pint**	**Pint**	**Pint**
Pint	**Pint**	**Pint**	**Pint**	**Pint**
Pint	**Pint**	**Pint**	**Pint**	**Pint**
Pint	**Pint**	**Pint**	**Pint**	**Pint**


Definitions
Characteristics
Examples
Non- examples

Around the World

Traveler _____

Destination	Event	Estimate	Actual	Difference
1. China 	Tea Time	_____cups	____cups	_____cup
2. Australia  Great Barrier Reef	Sponge Squeeze	______oz	______oz	______oz
3. Rome, Italy 	Sweet Honey	______pints	_____pints	_____pints
4. Egypt 	Pharaoh's perfume	______oz	______oz	______oz
5. Hershey Chocolate Factory- Pennsylvania, USA 	Sweet Tooth	______oz	_____oz	______oz

TOTAL _____

Do you like to travel? Let's go …..

AROUND THE WORLD!

Your job is to *estimate* and then *measure* the capacity of each of the objects in five different stations from different parts of the world.
The group that has the closest estimate to the actual measurement will receive a special prize!

First, a little history…..

CHINA- This very large country in Asia was the first who began boiling leaves from plants and flowers to make tea back in 350 A.D. Have you ever heard of Dandelion tea? Yes, they use the flowers just like the ones all over your backyard and it tastes yummy!

AUSTRALIA- This country is not only very large, but it is also its own continent. Australia is famous for its Great Barrier Reef which has many colorful fish, sharks, eels and yes, sea sponges! Did you know that sea sponges have no organs, muscles or nerves? They also have been around for over 500 million years! Sorry, you won't see Sponge Bob in Australia.

ITALY- What is your favorite drink? Well, ancient Romans drank a beverage that was made of grapes and honey. Hmm... does that sound good to you?

EGYPT- Did you know that King Tut wore perfume? Yep, that's right, but it was different than our modern day perfume. Ancient Egyptians used oils such as sesame and almond and mixed it with cinnamon, myrrh and the lotus flower.

HERSHEY, PA USA- If you love chocolate head up to Hershey, Pennsylvania. The Hershey factory makes the famous Hershey kisses and candy bars such as Reese's Peanut Butter Cups, Jolly Ranchers and Bubble Yum Bubble Gum. If you really love chocolate, you can buy a huge Hershey Kiss that is over 16 **ounces**!

ASSESSMENT

Answer the following questions by underlining the correct answer.

1. Trisha has a container that has a capacity larger than 2 cups but smaller than 1 gallon. Which of these could be the container?

□ 1 ounce □ 1 quart □ 3 ounces □ 1 pint

2. A container holds exactly 8 ounces of water. What might the container look like?

□ 1 quart □ 1 cup □ 1 ounce □ 1 Gallon

3. Sandra's dog spilled water on the kitchen floor. Sarah cleaned up the water with a sponge. Each time she squeezed water out of the sponge it measured 2 ounces. She repeated this 4 times. How much water was on the floor?

□ 1 cup □ 3 pints □ 6 cups □ 1 quart

4. How much liquid is in a 16 oz. glass?

□ 1 cup □ 1 gallon □ 2 quarts □ 1 pint

5. How many quarts of juice would I need to fill a one-gallon container?

□ 1 □ 5 □ 4 □ 7

Brief Constructed Response

Sheila wants to make 3 quarts of ice tea for her siblings. She has a choice of pitchers that have the capacity of a cup, pint, quart, and gallon.

Part A

If she could only use one pitcher for the ice tea, what size container would she use?

_____

Part B

Use what you know about capacity to explain why your answer is correct.

Use number and/or words in your explanation.

_____

_____

_____

_____

_____

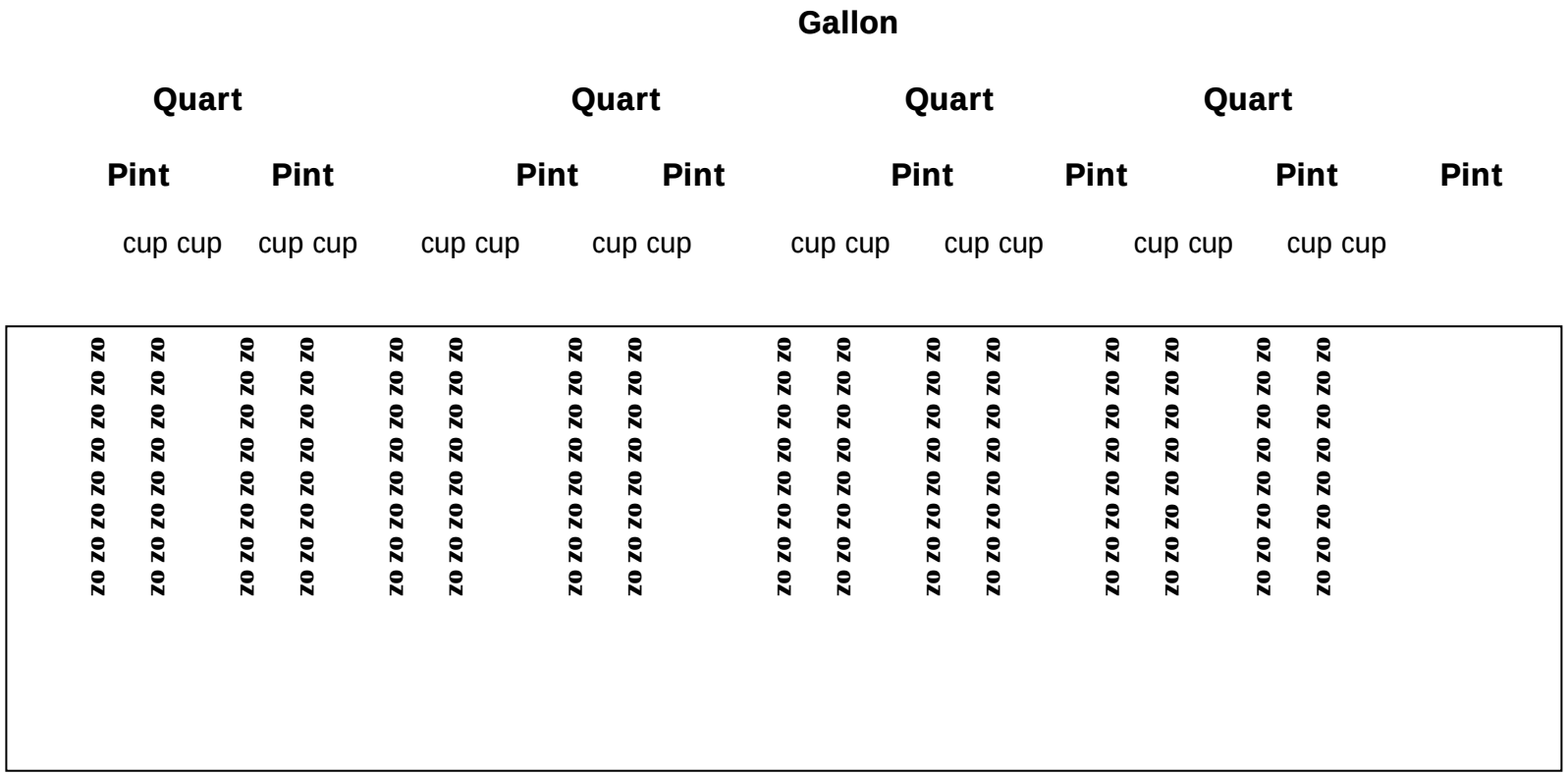
Directions for Capacity Graphic Organizer

1- Split students into 2-3 groups.
2- Hand out each group the following items:

- five pieces of large construction paper
- scissors
- tape
- colored markers

3- Inform students they will layer each color.
4- Show students your model.
5- After all sheets are layered instruct students to fold over 2 to 3 times the sheets (3-4 inches each).
6- Have students staple the folded edges (at the top of the organizer).
7- Have students write a capacity unit on each colored sheet in the following way: write word gallon once on a color.
8- Cut the next colored sheet into four even sections.
9- Write the word “quart” in each of the sections.
10-Cut the next sheet into eight even sections.
11- Write the words “pint” on each cut section.
12- Cut the next sheet into sixteen even sections.
13- Write the word “cup” on each cut section.
14- Cut the next sheet 128 times.
15- Write the word “ounce” on each cut section.

See the following diagram for visual aid.


Gallon
Quart
Quart
Quart
Quart
Pint
Pint
Pint
Pint
Pint
Pint
Pint
Pint
cup cup
cup cup
cup cup
cup cup
cup cup
cup cup
cup cup
cup cup
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz
oz oz oz oz oz oz oz oz

Before activity

- Make several copies of the game piece sheets for students to cut out. (See Student Resource 2)
- Distribute the game piece sheets to each group containing labels of gallon, quart, pint, cup and ounce.
- Instruct students to cut out all of the units of capacity sheets before they can play the game.

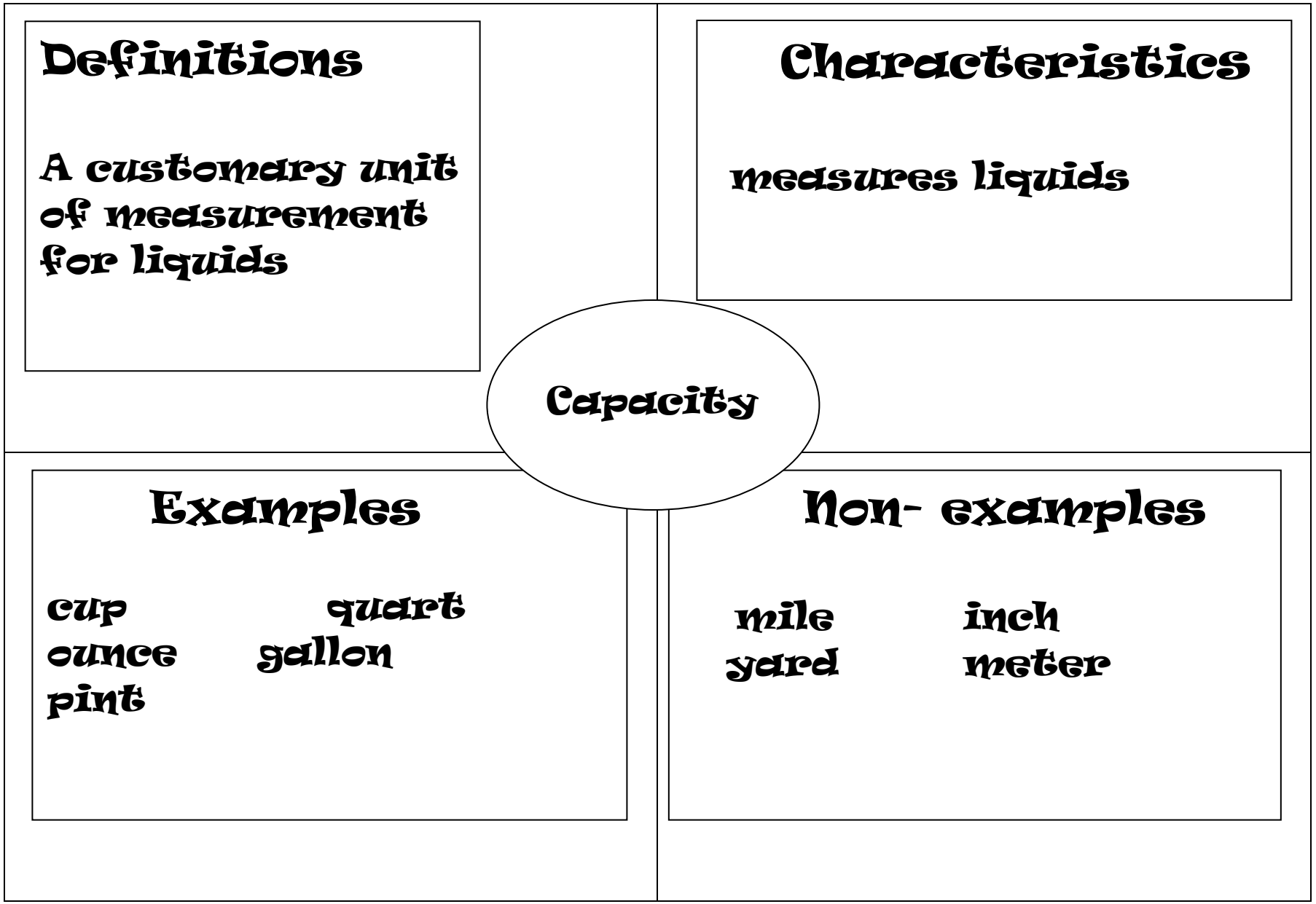
** *If time is short, have all of the units precut.*

- Split students into groups of 4-5.
- Distribute one die to each group.
  (Give pre-cut units if already done)
- Explain to students they will be playing a game converting the capacity units from smallest to largest.
- Inform students that the first person in their group to get to a gallon, WINS.
- Each student will take turns rolling a die.
- After rolling the die, they will take the appropriate **ounce** pieces.
- After the first roll students will have to convert :

  ounces to cups
  cups to pint
  pints to quarts
  quarts to a gallon.

- For example, on his first turn Leo rolls a six. Then on turn two, he rolls a four. Leo would take eight of the *ounce* pieces and trade them for a "one *cup"* piece.

- Play until there are winners (first student to get to a gallon) and/or up to 30 minutes where the player closest to a gallon wins..


Definitions
A customary unit of measurement for liquids
Characteristics
measures liquids
Capacity
Examples
cup
quart
ounce
gallon
pint
Non- examples
mile
inch
yard
meter

Around the World!

- This game allows students to practice estimation and actual measurement of capacity.
- Each group of students will go to one of five stations and complete the activity. When every group has finished, each group will rotate to the next station. Allow a good 5-7 minutes for each station. A timer could be used.
- This activity will take approximately 30 minutes.

Set up-
Instructor will need the following items before today's lesson.

- There will be five stations for the students. In each station, a clear large measuring cup will be needed that shows the actual measurement in ounces, cups, pints and quarts on the side.
- For stations in China and Italy, students will be pouring each liquid into another container.
- For the Australia station, students will be squeezing a sponge into another container.
- For Hershey, pour an amount of chocolate syrup into a clear measuring cup that shows ounces. Place a piece of masking or black tape over the actual measurement. After estimating, students will lift off the tape the look at the actual measurement.
- Egypt can be prepared two ways. If a perfume bottle is being used, try to use a full bottle and tape over the actual measurement that is written on the bottle. If making perfume with oil, cinnamon etc., place mixture in a clear measuring cup and again place tape over the actual measurement.

If possible, have different sized measuring containers, so it will be more challenging for students.

The following items are needed at each station
(Separated by country)

China-

a. gallon or quart container
b. iced tea (any type)
c. large clear measuring cup

Australia-

a. sponge
b. medium sized container
c. water
d. clear measuring cup

Italy- (can use honey, colored water or grape juice)

a. large container of honey, grape juice or water with food coloring
(if using honey, leave full amount of honey in container and blackout the measurement on the container)
b. large clear measuring cup

Egypt-

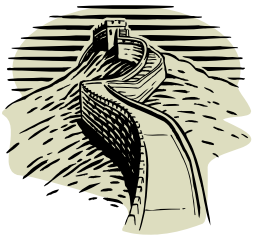
a. one or two bottles of perfume or
b. mix oil, water and cinnamon together for homemade perfume
c. clear measuring cup

Hershey-

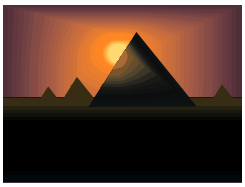
a. chocolate syrup
b. clear measuring cup
c. tape

Read instructions to students before they begin (Student Resource 5).

Welcome to the Far East! China is one of the first countries to drink tea! Please estimate and then measure how much tea is in this container!






Imagine walking in the desert or helping to build one of the Great Pyramids of Egypt. Egyptians were one of the first civilizations to wear perfume. Estimate this concoction of oil, water and cinnamon and then see how close you really are!

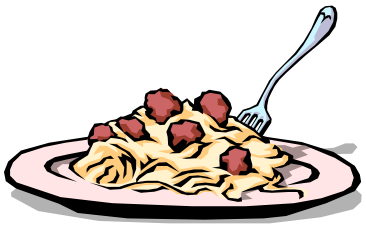
Welcome to Hershey, Pennsylvania USA! The largest chocolate factory in the United States! We make everything in chocolate and lots of other candy, too!

Please look at the Hershey's syrup and estimate the amount. Then look under the tape to see how close you are! Good luck

Good Day Mate! Thanks for traveling to Australia! We have the most beautiful coral reef here to go snorkeling or scuba diving! Now squeeze the sponge to see how much water you can get!

Bonjourno! Here in Italy we are not only famous for our pasta and meatballs, but have many ancient statutes and buildings here!

We love grapes, too. Can you guess how many ounces, pints or cups is in this container? Remember to estimate and then measure it out.



Answer the following questions by marking the correct answer.

1. Trisha has a container that has a capacity larger than 2 cups but smaller than 1 gallon. Which of these could be the container?

□ 1 ounce □ 1 quart □ 3 ounces □ 1 pint

2. A container holds exactly 8 ounces of water. What might the container look like?

□ 1 quart □ 1 cup □ 1 ounce □ 1 Gallon

3. Sandra's dog spilled water on the kitchen flour. Sarah cleaned up the water with a sponge. Each time she squeezed water out of the sponge it measured 2 ounces. She repeated this 4 times. How much water was on the floor?

□ 1 cup □ 3 pints □ 6 cups □ 1 quart

4. How much liquid is in a 16 oz. glass?

□ 1 cup □ 1 gallon □ 2 quarts □ 1 pint

5. How many quarts of juice would I need to fill a one-gallon container?

□ 1 □ 5 □ 4 □ 7

Brief Constructed Response

Sheila wants to make 3 quarts of ice tea for her siblings. She has a choice of pitchers that have the capacity of a cup, pint, quart, and gallow.

Part A

If she can only use one pitcher for the ice tea, what size container would she use?

gallon

Part B

Use what you know about capacity to explain why your answer is correct. Use number and/or words in your explanation.

You could only use a gallon container because it takes four quarts to make a gallon. You could not use anything else because there is no larger unit for capacity than gallon.